INVASIVES

Newsletter of the Asia-Pacific Forest Invasive Species Network (APFISN)

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Threats

- Red palm mite (*Raoiella indica*)

News column

- Will climate change wake up sleeper weeds?
- Invasive species threaten Salmon in the Pacific Northwest

New publications

- Linking invasions and biogeography: Isolation differentially affects exotic and native plant diversity
- Why forests appear resistant to exotic plant invasions: intentional introductions, stand dynamics, and the role of shade tolerance
- Twenty years of zebra mussels: lessons from the mollusk that made headlines
- Different climatic envelopes among invasive populations may lead to underestimations of current and future biological invasions
- Contrasting patterns of genetic variation and structure in plant invasions of mountains
- Evidence for the evolution of reduced mycorrhizal dependence during plant invasion
- Managing the impact of invasive species: the value of knowing the density–impact curve

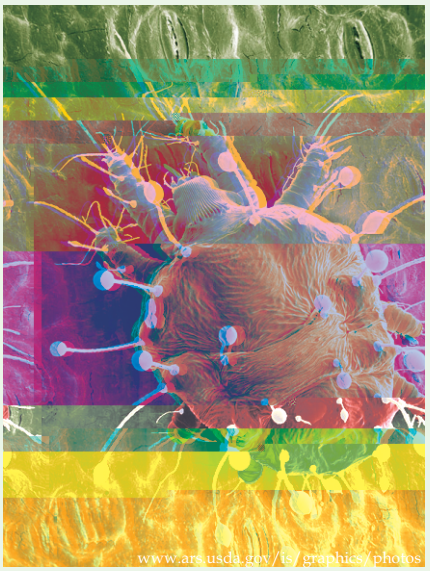
Recent books

- Weedy and Invasive Plant Genomics
- Invasive Species Management: A Handbook of Techniques (Techniques in Ecology & Conservation)

Forthcoming Symposia/Workshops

- 4-8 August 2009. 1st World Congress of Environmental History, Copenhagen, Denmark.

The Asia-Pacific Forest Invasive Species Network (APFISN) has been established as a response to the immense costs and dangers posed by invasive species to the sustainable management of forests in the Asia-Pacific region. APFISN is a cooperative alliance of the 33 member countries in the Asia-Pacific Forestry Commission (APFC) - a statutory body of the Food and Agriculture Organization of the United Nations (FAO). The network focuses on inter-country cooperation that helps to detect, prevent, monitor, eradicate and/or control forest invasive species in the Asia-Pacific region. Specific objectives of the network are: 1) raise awareness of invasive species throughout the Asia-Pacific region; 2) define and develop organizational structures; 3) build capacity within member countries and 4) develop and share databases and information.



Red palm mite - Habit

INVASIVES, bimonthly newsletter of the Asia-Pacific Forest Invasive Species Network (AFPISN) is intended to share information among countries in the Asia-Pacific region on Forest Invasive Species(FIS) and the threats they pose in the region. If you have any items of news value on FIS to share between national focal points of APFISN and more widely among foresters, agriculturists, quarantine personnel and policy makers, please pass them on to the editor - Dr. K. V. Sankaran, APFISN Coordinator, Kerala Forest Research Institute, Peechi-680 653, Kerala , India (sankaran@kfri.org). The newsletter is supported by the Food and Agriculture Organization of the United Nations (FAO) and USDA Forest Service.

Red palm mite (*Raoiella indica*)

Raoiella indica, the red palm mite, or RPM, is an invasive mite which poses a serious threat to various ornamental and fruit-producing palm species in many countries in the tropics. RPM was first reported from India in 1924. Its recent invasion is referred to as the biggest mite explosion in the Americas. RPM has been reported to affect 32 palm species, including coconut, areca and date palm. However, evidence indicates that a majority of the palm species are hosts of this mite. The mite is common in India, Pakistan, Philippines, Sri Lanka, Thailand and the USA. In the Caribbean, it causes severe damage to banana cultivations. The mite also infests bananas in Kerala (India), during peaks in population.

The infestation by the mite is promoted by hot, dry weather. Continuous humidity or the rainy season tends to depress the mite population. In India, the peak in population is reached during March to May and the major host plants are areca and coconut palm. Ornamental palms, including hurricane or princess palm (*Dictyosperma album*) and Christmas palm (*Veitchia merrillii*) have also been damaged. Palms are important components of our tropical landscapes, both indoors and out, and in many countries coconut palms, *Cocos nucifera*, and date palms, *Phoenix dactylifera*, are important food crops. The red palm mite causes economic damage to tropical and subtropical agriculture and to urban and indoor environments where palms are grown. Palm nurseries, landscape palms and horticultural gardens are also affected by RPM.

Red palm mites can easily be distinguished from most spider mites by their bright red color and absence of webbing. All life stages of RPM, including the eggs, are red. They do not produce silk, which is common in most spider mites. They are visible to the naked eye and are slow moving compared to spider mites. These mites congregate in clusters of 100-300, and are surrounded by their white exuvial remains.

RPM infestation on Coconut leaf

The adult females of *R. indica* are ca. 0.01 inches long and 0.007 inches wide and oval in shape. They develop dark markings on the dorsum of the body after feeding. The dorsum is smooth, except for the presence of punctae (sculptured depressions). The male is smaller, but similar to the female in shape except for having a tapering of the posterior end of the body. Adult females are larger than males and less active. Males and females are sexually mature when they emerge and males actively seek out females, suggesting there is a sex pheromone involved. When a male locates a female deutonymph in the quiescent stage, he will settle close to it and wait for up to two days for her to molt. When female deutonymphs begin to molt, the male becomes active and moves under her, bending his posterior up and forwards to mate. Mites remain in the mating posture for about 16 minutes.

Red palm mite attack on Areca palm

The life cycle from egg to adult typically requires 23 to 28 days for females and 20 to 22 days for males. Mated females have a 5 to 6 day pre-oviposition period and oviposit for 47 days under laboratory conditions. Unmated females deposit an average of 18 eggs after a 2-day pre-oviposition period, oviposit for 40 days and live for ca. 48 days. Males, produced by unmated females, live an average of 22 days. The ovoid egg is reddish, 0.003 inches long and 80 microns wide. The freshly laid egg is attached to the leaf surface and a fine white stipe (slender hair like structure) as long as or longer than the egg is present at one end. The tip of the stipe may be coiled and have a droplet of water clinging to it. The egg turns opaque white about 24 hours before hatching. The incubation period averages eight days for fertilized eggs and 7.3 days for unfertilized eggs.

The reddish mites are easily seen against green leaves. Heavy infestations of the mites are typically found on the lower surface of the leaves. Yellow speckles and blotches on the leaves result from the feeding damage. White skin castings are also observed on the leaves. Yellowing of the leaves may often be severe. Affected palms show scattered yellow spots or strong discoloration of the entire leaflet; most of the leaflets affected are located in the middle area of the leaf. It is unknown if this condition is solely the result of mite feeding in combination with the dry season or the presence of a plant pathogen transmitted by the mite. There is no information as to whether this mite is a disease vector. Very young coconut palms to very old

palms (more than 50 feet tall) can all be severely affected. However, young coconut plants are the worst affected. The yellow color of the leaflets is followed by the abortion of the flowers or small nuts in coconut palms. Wind currents and the trade of infested palms are the major pathways of mite dispersal. Dispersal can also occur through cut branches of host plants and through nurseries. The potential preventive measures include creative awareness and surveys for infestation. Strict quarantine measures should be imposed during the import of palms and palm materials.

Infected Coconut palm

Chemical control measures include spraying of neem oil mixed with sulfur on infested coconut palms 5-6 times a year. Several systemic insecticides have proven toxic to *R.indica*. These include Phosphamidon (which is the most effective), monocroptophos, dimethoate, formothion, and dementon-methyl. Most of these products are not registered for use on coconuts or bananas in Florida and Puerto Rico. A full evaluation before use on commercial food crops is required. Additionally, petroleum oil, pyridaben, fentbutatin-oxide, dicofol and high rates of sulfur have been successful in controlling mite populations.

Natural predators may also provide a means of controlling red palm mite populations; however, more research would be necessary before attempting this in the field. Possible predator species in India include the phytoseiid mite (*Amblyseius channabasavanni*), lady bird beetle (*Stethorus keralicus*), and *Stethorus parcempunctatusi*. In Mauritius, *Amblyseius caudatus* preys on red palm mites in coconut palms. In the Western Hemisphere, *Neoseiulus longipinosus*, also native to the East, has been found to prey on *R. Indica* in the Caribbean. Also, there are several other conccinellids and phytoseiids that are potential endemic predators that are found to prey on similar species in the Western Hemisphere. The USDA Bee Research Laboratory has searched for predators by looking for a sequenced portion of *R. indica* DNA in the guts of potential candidates. They have found lacewings (Chrysopidae spp.) to be good predators and intend to use a chemical isolated from catnip-oil to attract them to prey on *R. indica* populations. Another possibility lies in predatory beetles of the Chrysomelidae family. Utilizing arachnid pathogens such as fungi may prove to be yet another means of controlling *R. indica*. A fungus, possibly, *Hirsutella* spp., has been observed infecting the red palm mite. The Kerala Forest Research Institute, India, has recently taken up a research program in collaboration with CABI, UK to explore the presence of natural enemies of the RPM in India.

News column

Will climate change wake up sleeper weeds?

A recent report by CSIRO, Australia, examined whether climate changes anticipated for 2030 and 2070 would impact the distribution of 41 weeds that pose a threat to agriculture ("sleeper species") and the natural environment ("alert species") in Australia. The report says that the climate change will cause most of these weeds to shift south, with wet tropical species making the greatest move perhaps over 1,000 kilometers. The regions most at threat from alert and sleeper weeds under the current climate are southeast Australia, followed by the southwest. According to Dr. John Scott (CSIRO, Australia), the predicted move south by both native and introduced plants would produce a vacuum in northern Australia. So, in order to prevent lurking species from invading, a new list of alert and sleeper weeds for this region needs to be developed. He also pointed out that while the area currently infested by the most widespread weeds will decrease under climate change, the area of high risk would still be large. There are many weed species lying low in Australia, but with the potential to take off and add to the economic and social burden of weed control. Weeds incur a cost A$4 billion a year in Australia either in control or lost production.

Invasive species threaten Salmon in the Pacific Northwest

Many native fishes in the Pacific Northwest, most notably salmonids, are threatened or endangered, and hundreds of millions of dollars are spent annually to study their populations and to develop amelioration efforts. The studies are mostly concentrated on the impacts of habitat alteration, hatcheries, harvest, and the hydrosystem. However, a recent study published in the journal BioScience shows that non-indigenous species may pose at least as much of a threat to native salmonids, principally through predation.

Beth L. Sanderson and colleagues of the Northwest Fisheries Science Center in Seattle, USA, drew these conclusions after assembling all known occurrence and distribution records for non-indigenous species found in roughly 1,800 km^2 of hydrologically connected areas throughout Washington, Oregon, and Idaho. The data collected by them indicated that non-indigenous species of mainly plants and fish are present in all of those hydrologically connected areas and their numbers varied between watersheds. It was as high as 486 in some watersheds.

New publications

Jeremy, D. L., Geoffrey C. T. and E. Ted. 2009. Linking invasions and biogeography: Isolation differentially affects exotic and native plant diversity. Ecology, 90: 863 - 868.

Patrick, H. M., Charles, D. C. and L. M. Peter. 2009. Why forests appear resistant to exotic plant invasions: intentional introductions, stand dynamics, and the role of shade tolerance. Frontiers in Ecology and the Environment, 7: 142 - 149.

Strayer, D. L. 2009. Twenty years of zebra mussels: lessons from the mollusk that made headlines. Frontiers in Ecology and the Environment, 7: 135 - 141.

Linda, J. B., Rachael, V. G., Wilfried, T., Paul, O. D., Michelle, R. L. and L. Hughes. 2009. Different climatic envelopes among invasive populations may lead to underestimations of current and future biological invasions. Diversity and Distributions, 15: 409 - 420.

Jake, M. A., Myriam, P., Hansjörg, D. and J. E. Peter. 2009. Contrasting patterns of genetic variation and structure in plant invasions of mountains. Diversity and Distributions, 15: 502 - 512.

Seifert, E. K., Bever, J. D. and J. L. Maron. 2009. Evidence for the evolution of reduced mycorrhizal dependence during plant invasion. Ecology, 90: 1055 - 1062.

Yokomizo, H., Possingham,H. P., Thomas, M. B. and Y. M. Buckley. 2009. Managing the impact of invasive species: the value of knowing the density impact curve. Ecological Applications, 19: 376 - 386.

Recent Books

Weedy and Invasive Plant Genomics: By C. Neal Stewart Jr., Wiley-Blackwell, 2009. This book offers a comprehensive, up-to-date reference on genetic and genomics research in weedy and invasive plants. The book also assesses the areas of future research necessary to control them.

Invasive Species Management: A Handbook of Techniques (Techniques in Ecology & Conservation): Eds. Michael N. Clout, Peter A. Williams, Oxford University Press, USA, 2009. Invasive alien species are a major and growing threat to biodiversity worldwide. This book provides strategies for managing these species at successive invasion stages, from prevention at the border and control of major infestations. It also describes the general tools and approaches that are recommended for successful management of particular groups of invasive organisms in a range of environments. In each case, the ecological basis and practical requirements of invasive alien species management are addressed.

Forthcoming Symposia / Workshops

4 - 8 August 2009. 1st World Congress of Environmental History, Copenhagen, Denmark. The theme of the congress is "Local livelihoods and global challenges: understanding human interaction with the environment." Humans interact and communicate with the environment globally, to make their livelihoods, create artifacts, for recreational purposes, to reflect their belief systems, and for survival. Man has changed the earth's face and experienced both the resilience and degradation of natural systems. Environmental historians study these interactions and aim their explorations toward a sustainable future. This world congress, hosted by an international consortium of environmental history organizations, will bring together around 600 scholars from more than 50 countries worldwide, providing a unique opportunity to learn from each other and together create an overarching picture of the historic relationship of people and the environment through time. Contact: Bo Poulsen; bopo@ruc.dk

Compiled and edited by Dr. K. V. Sankaran, APFISN Co-ordinator on behalf of the Asia-Pacific Forest Invasive Species Network. For more information on the APFISN, please contact your national focal point or the APFISN Co-ordinator or Mr. Patrick Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok. Email: patrick.durst@fao.org